regarded as the components of one and the same wave. He obtains three other equations between the amplitudes from the simple consideration that a particle situated in the common surface of the two media cannot vibrate in more than one way at once. Of these three equations two involve the amplitudes of the first component wave, and the third those of the second. The five equations serve to determine, in terms of the angle of incidence and the component amplitudes of the incident wave, the five following quantities, namely, the angle of refraction, the two component amplitudes of the reflected wave, and those of the refracted wave.

By the aid of the result referred to, that every loss of *vis viva* is always accompanied by a diminution of the refractive index, coupled with the general view which he takes of the cause of absorption, the author is enabled to give an explanation of Frauenhofer's lines, and in general of the lines of absorption in coloured media; and also to explain the phenomena discovered by Sir David Brewster, that violet light may exist in the blue spaces, and blue light in the red.

In the course of the investigation, the altered expressions for the intensities of the reflected and refracted rays, so far as they are affected by the coefficient of absorption, are given. The expressions for the intensities of the two component reflected waves are very little affected; but those for the intensities of the two component refracted waves are materially altered in value.

The theory likewise affords an explanation, the first the author believes that has ever been offered, of the remarkable properties of saccharine solutions and of certain crystals, such as right-handed and left-handed quartz, which exhibit the phenomenon of circular polarization.

June 16, 1853.

The EARL OF ROSSE, President, in the Chair.

The following gentlemen were admitted into the Society:—

Joseph Prestwich, Esq.; William Wilson Saunders, Esq.; and William Spottiswoode, Esq.

The following papers were read:—

1. "On the Anatomy and Physiology of *Cordylophora*, a contribution to our knowledge of the Tubularian Zoophytes." By George James Allman, M.D., M.R.I.A., Professor of Botany in the University of Dublin, &c. Communicated by Professor Edward Forbes, F.R.S. &c. Received May 31, 1853.

The author, after pointing out the necessity of giving greater definiteness to the terminology employed in the description of the true zoophytes, proceeds to the anatomical details of *Cordylophora*, a genus of *Tubulariadæ*. He demonstrates that *Cordylophora* is essentially composed in all its parts of two distinct membranes enclosing a cavity, a structure which is common to all the *Hydroida*. For greater precision in description, he finds it necessary to give to these

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membranes special names, and he therefore employs for the external the name of *ectoderm*, and for the internal that of *endoderm*. Each of these membranes retains its primitive cellular structure. In the ectoderm *thread-cells* are produced in great abundance; these are formed in the interior of the ectodermal cells by a process of endogenous cell-formation, and are afterwards set free by the rupture of the mother-cell. The thread-cells in a quiescent state are minute ovoid capsules, but under the influence of irritation, an internal sac is protruded by a process of evagination; the surface of the evaginated sac is furnished with a circle of curved spicula, and from its free extremity a delicate and long filament is emitted. The thread-cells of *Cordylophora* thus closely resemble the "hastigerous organs" of *Hydra*. The polypary is a simple unorganized secretion deposited in layers from the ectoderm. In the endoderm, the author points out a distinct and well-developed glandular structure composed of true secreting cells, which are themselves produced in the interior of mother-cells, and elaborate a brown granular secretion which he assumes as representing the biliary secretion of the higher animals. He describes, as a system of special muscles, certain longitudinal fibres, which may be distinctly seen in close connection with the inner surface of the ectoderm. The tentacula are shown to be continuous tubes communicating with the cavity of the stomach, and thus possess the same essential structure as those of *Hydra*; they are formed of a direct continuation of the ectodern of the polype, lined by a similar continuation of the endoderm. The appearance of transverse septa at regular intervals, which is so very striking in these tentacula, must not be attributed to the existence of true septa. It is due to a peculiar condition of the endodermal layer, but the author has not been able to give a satisfactory explanation of it. Through the whole of the canal which pervades the axis of the stems and branches, a constant though a regular rotatory movement is kept up in the contained fluid; this movement is not due to the propulsive action of vibratile cilia, and is explained by the author as the effect of the active processes going on in the secreting cells of the endoderm, processes which can scarcely be imagined to take place without causing *local* alterations in the chemical constitution of the surrounding fluid, and a consequent disturbance in its stability.

The reproductive system of *Cordylophora* consists of ovoid capsules situated on the ultimate branches at some distance behind the polypes; some of these capsules contain *ova*, others *spermatozoa*; they are plainly homologous with the ovigerous sacs of the marine *Tubulariadæ*; they present a very evident, though disguised medusoid structure, having a hollow cylindrical body, whose cavity is continuous with that of the polype-stem, projecting into them below, and representing the proboscidiform stomach of a Medusa, while a system of branched tubes which communicate at their origin with the cavity of the hollow organ, must be viewed as the homologues of the radiating gastro-vascular canals, and the proper walls of the capsule will then represent the disc. From comparative observations made on other genera of *Hydroida*, the author maintains the presence of a true medusoid structure in the fixed ovigerous vesicles of all the genera he has examined, and he arrives at the generalization, that for the production of true ova in the hydroid zoophytes, a particular form of zooid is necessary, in which the ordinary polype-structure becomes modified, and presents, instead, a more or less obvious medusoid conformation, *Hydra* being at present the only genus which appears to offer an exception to this law, though the author believes that the exception is only apparent, and that further observations will enable us to refer the reproductive organization of this zoophyte to the same type with that of *Cordylophora* and the marine *Hydroida*. The author has satisfied himself that the ova-like bodies contained in the capsules of *Cordylophora* are true *ova*, and not *gemmæ*; he has demonstrated in them a distinct germinal vesicle, and has witnessed the phenomenon of yelk-cleavage; and the paper details the development of the embryo to the period of its escape from the capsule in the form of a free-swimming ciliated animacule, and traces its subsequent progress into the condition of the adult zoophyte.

2. "On the Secular Variation of the Moon's Mean Motion." By J. C. Adams, Esq., M.A., F.R.S. &c. Received June 16, 1853.

The author remarks, that in treating a great problem of approximation, such as that presented to us by the investigation of the moon's motion, experience shows that nothing is more easy than to neglect, on account of their apparent insignificance, considerations which ultimately prove to be of the greatest importance. One instance of this occurs with reference to the secular acceleration of the moon's mean motion. Although this acceleration and the diminution of the eccentricity of the earth's orbit, on which it depends, had been made known by observation as separate facts, yet many of the first geometers altogether failed to trace any connexion between them, and it was not until he had made repeated attempts to explain the phenomenon by other means, that Laplace himself succeeded in referring it to its true cause.

The accurate determination of the amount of the acceleration is a matter of very great importance. The effect on the moon's place, of an error in any of the periodic inequalities, is always confined within certain limits, and takes place alternately in opposite directions within very moderate intervals of time, whereas the effect of an error in the acceleration goes on increasing for an almost indefinite period, so as to render it impossible to connect observations made at very distant times.

In the 'Mécanique Céleste,' the approximation to the value of the acceleration is confined to the principal term, but in the theories of Damoiseau and Plana, the developments are carried to an immense extent, particularly in the latter, where the multiplier of the change in the square of the eccentricity of the earth's orbit, which occurs in the expression of the secular acceleration, is given to terms of the seventh order.